



US007999163B2

(12) **United States Patent**  
**Geoghegan**

(10) **Patent No.:** **US 7,999,163 B2**  
(45) **Date of Patent:** **Aug. 16, 2011**

- (54) **SUPPORT FOR A PIANO LID**
- (75) Inventor: **Daniel E. Geoghegan**, Boca Raton, FL (US)
- (73) Assignee: **Magic Lid, LLC**, Pompano Beach, FL (US)
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 134 days.

6,545,203	B2	4/2003	Arimori
6,946,591	B2	9/2005	Lee
7,140,588	B2	11/2006	Shirayanagi et al.
7,155,777	B2	1/2007	Connors et al.
2005/0092891	A1	5/2005	Shirayanagi et al.
2006/0000056	A1	1/2006	Connors et al.

**FOREIGN PATENT DOCUMENTS**

EP	1361390	11/2003
JP	09-146534	6/1997
JP	11-231861	8/1999
JP	11-272262	10/1999
JP	11-305761	11/1999
JP	11305761 A	* 11/1999

**OTHER PUBLICATIONS**

Written Opinion of the International Searching Authority in related international application No. PCT/US2009/030859 mailed Jun. 15, 2009 (8 pages).

Written Opinion of the International Preliminary Examining Authority in related international application No. PCT/US2009/030859 mailed Jul. 29, 2010 (5 pages).

\* cited by examiner

*Primary Examiner* — Kimberly Lockett

(74) *Attorney, Agent, or Firm* — Margaret Polson; Abigail Smith; Oppedahl Patent Law Firm LLC

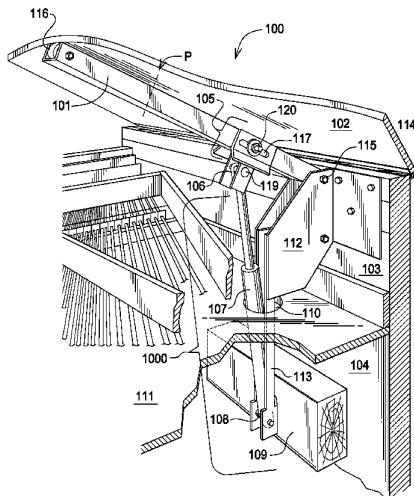
- (21) Appl. No.: **12/503,596**
- (22) Filed: **Jul. 15, 2009**
- (65) **Prior Publication Data**  
US 2009/0277317 A1 Nov. 12, 2009
- Related U.S. Application Data**
- (63) Continuation-in-part of application No. PCT/US2009/030859, filed on Jan. 13, 2009.
- (60) Provisional application No. 61/021,263, filed on Jan. 15, 2008.

- (51) **Int. Cl.**  
**G10C 3/02** (2006.01)
- (52) **U.S. Cl.** ..... **84/179**
- (58) **Field of Classification Search** ..... 84/7, 79,  
84/174, 177-179  
See application file for complete search history.

- (56) **References Cited**  
**U.S. PATENT DOCUMENTS**  
3,710,954 A 1/1973 Hutchison  
3,969,970 A 7/1976 Swift et al.  
D277,764 S 2/1985 Henkle  
6,055,779 A 5/2000 Yang  
6,469,237 B1 10/2002 Arimori  
6,506,966 B2 1/2003 Miura

(57) **ABSTRACT**  
A mechanism for supporting the weight of a piano lid is disclosed. One or more pneumatic cylinders and arms are used to assist a user in opening and closing the piano lid. In one embodiment, a guiding cup can be removably attached to the frame of the piano below each pneumatic cylinder. When the piano lid is open, the piston arm of the pneumatic cylinder engages the guiding cup. Because the pneumatic cylinder is not attached to the piano frame, the piano lid can be completely removed without the use of tools. Another embodiment provides a mounting bracket that fits over the rear frame of a piano, allowing the mechanism to be retrofit to any existing piano without any damage thereto.

**21 Claims, 6 Drawing Sheets**



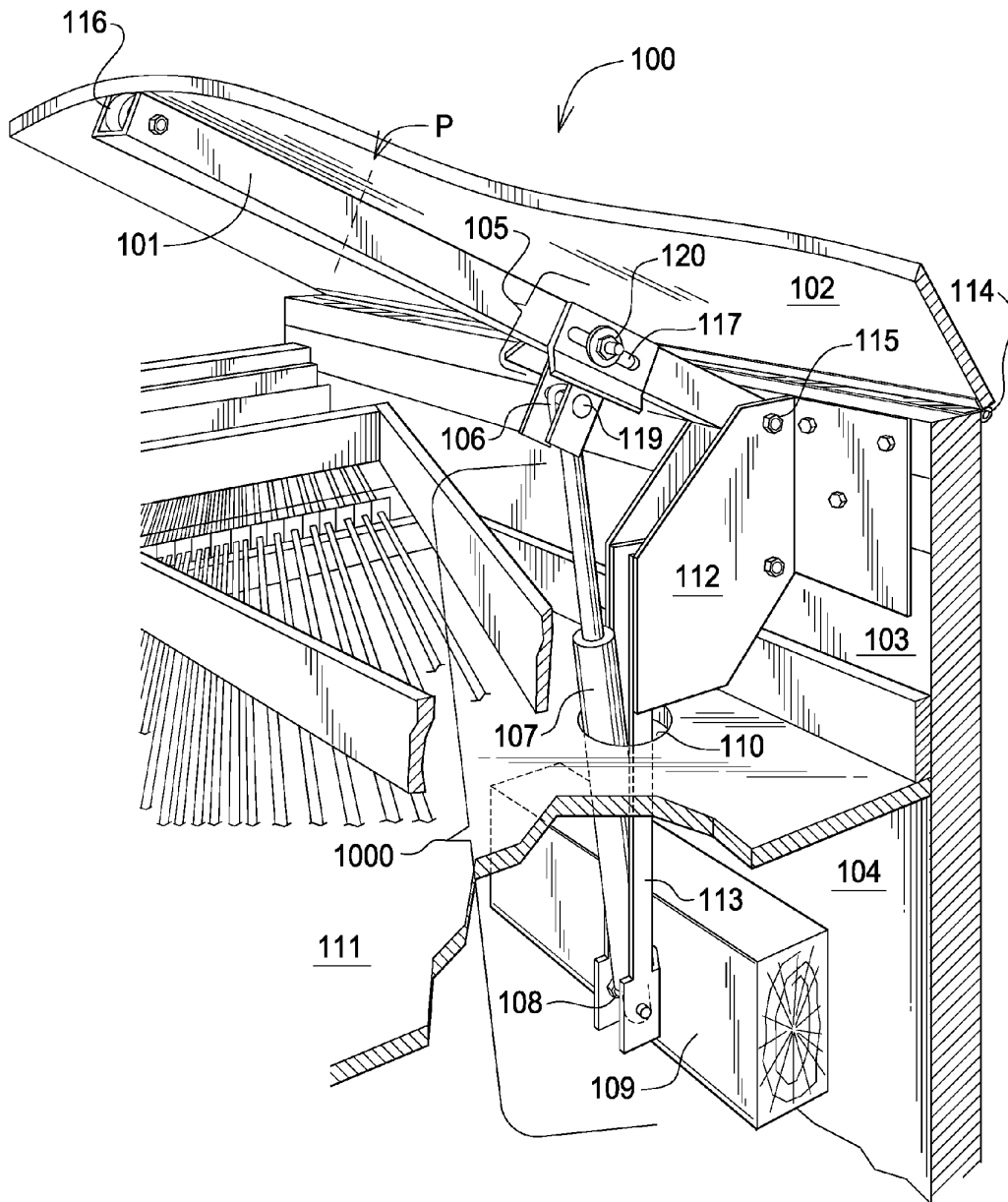


FIG.1

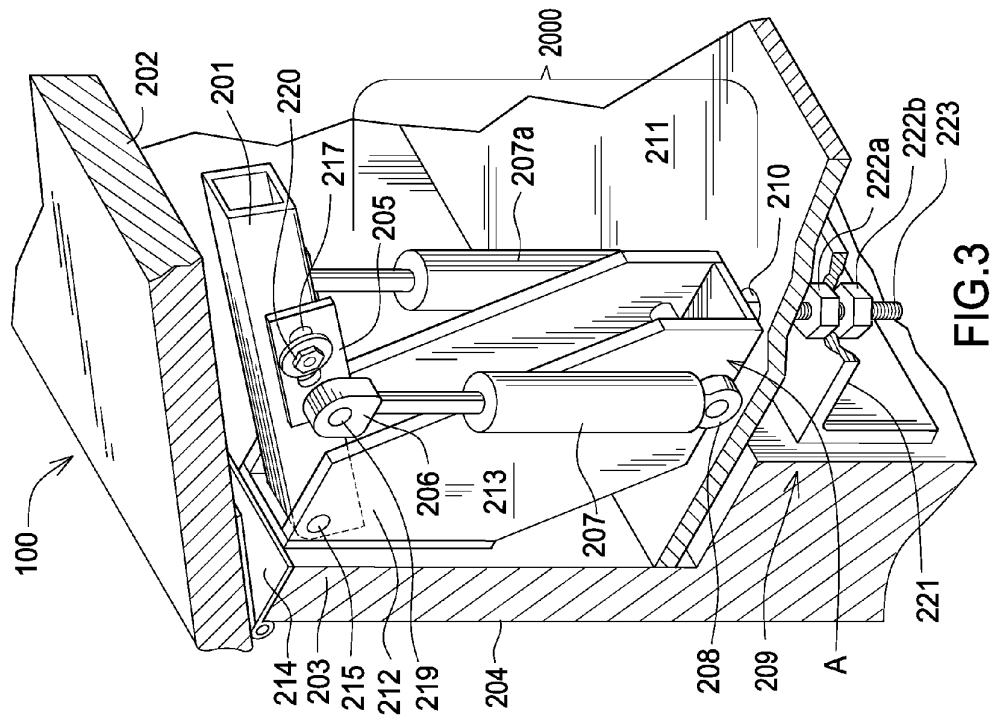


FIG. 3

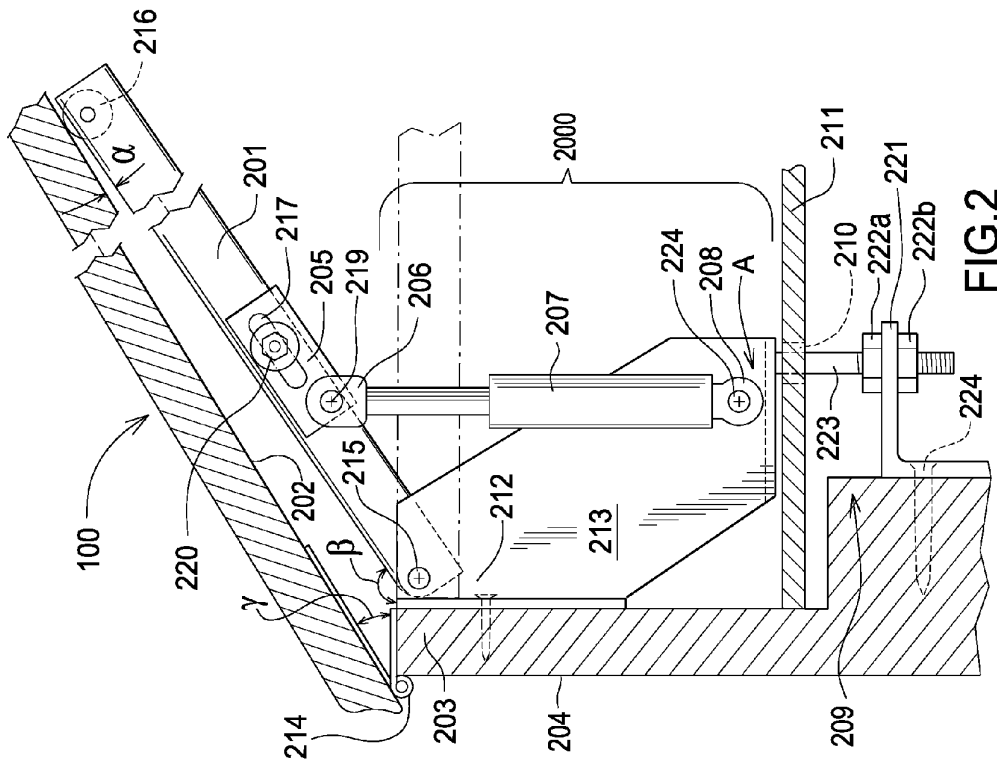
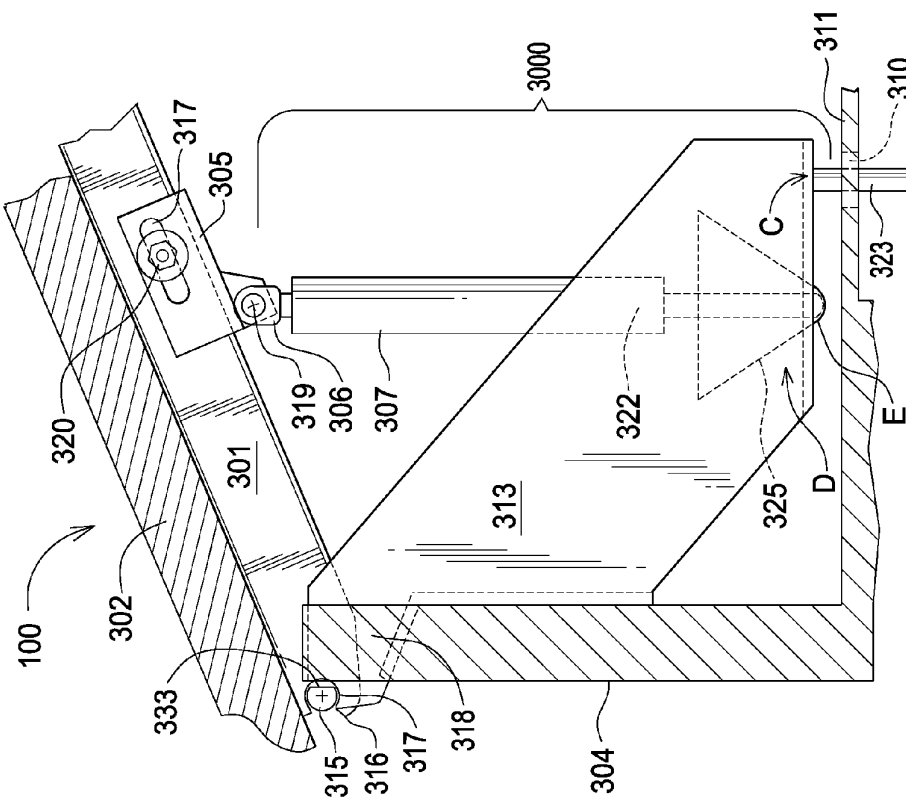
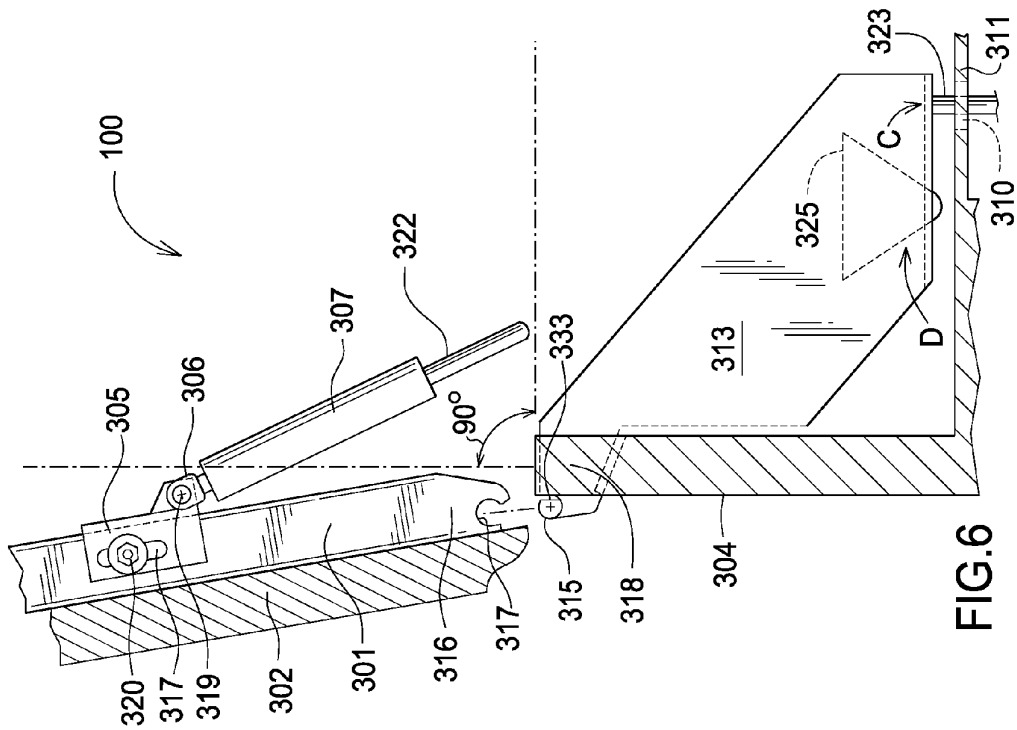


FIG. 2





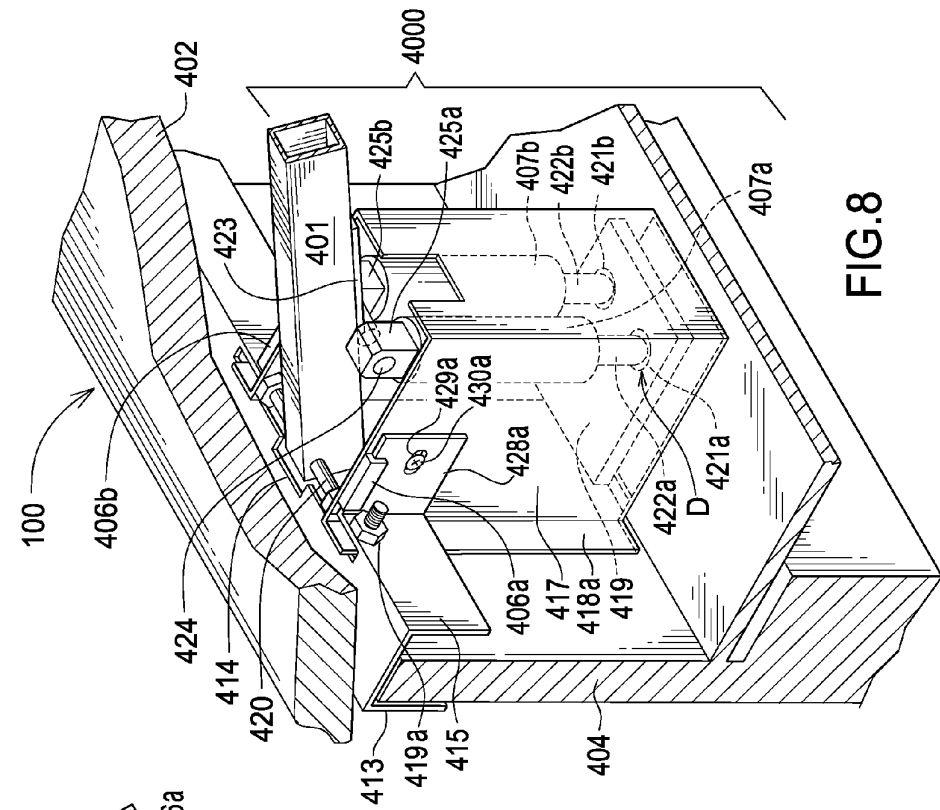


FIG. 8

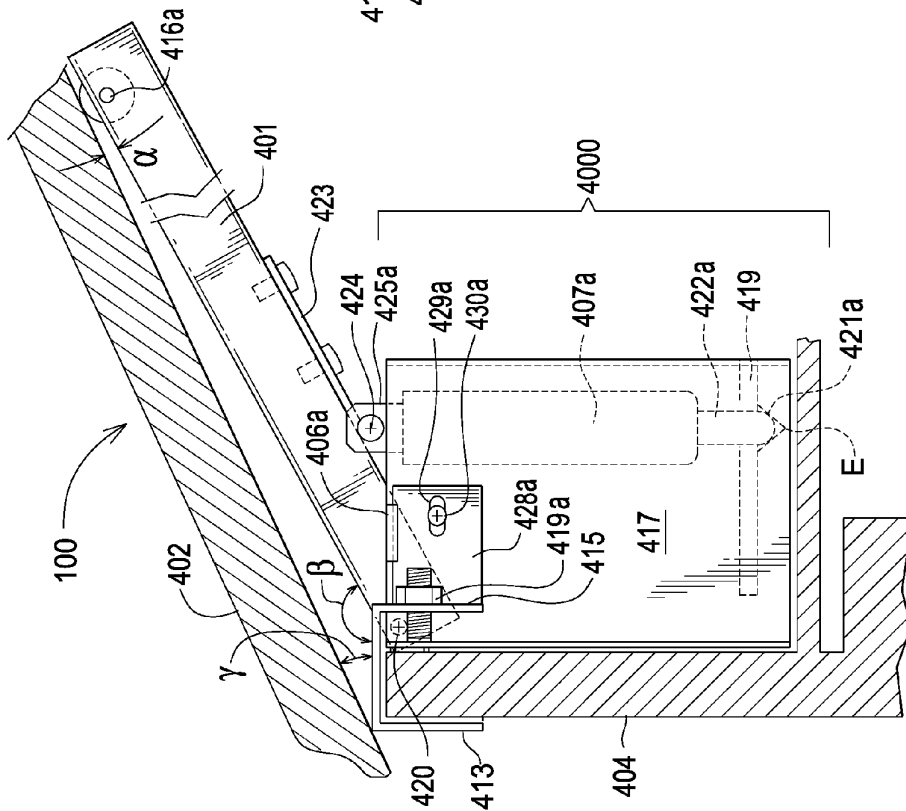


FIG. 7

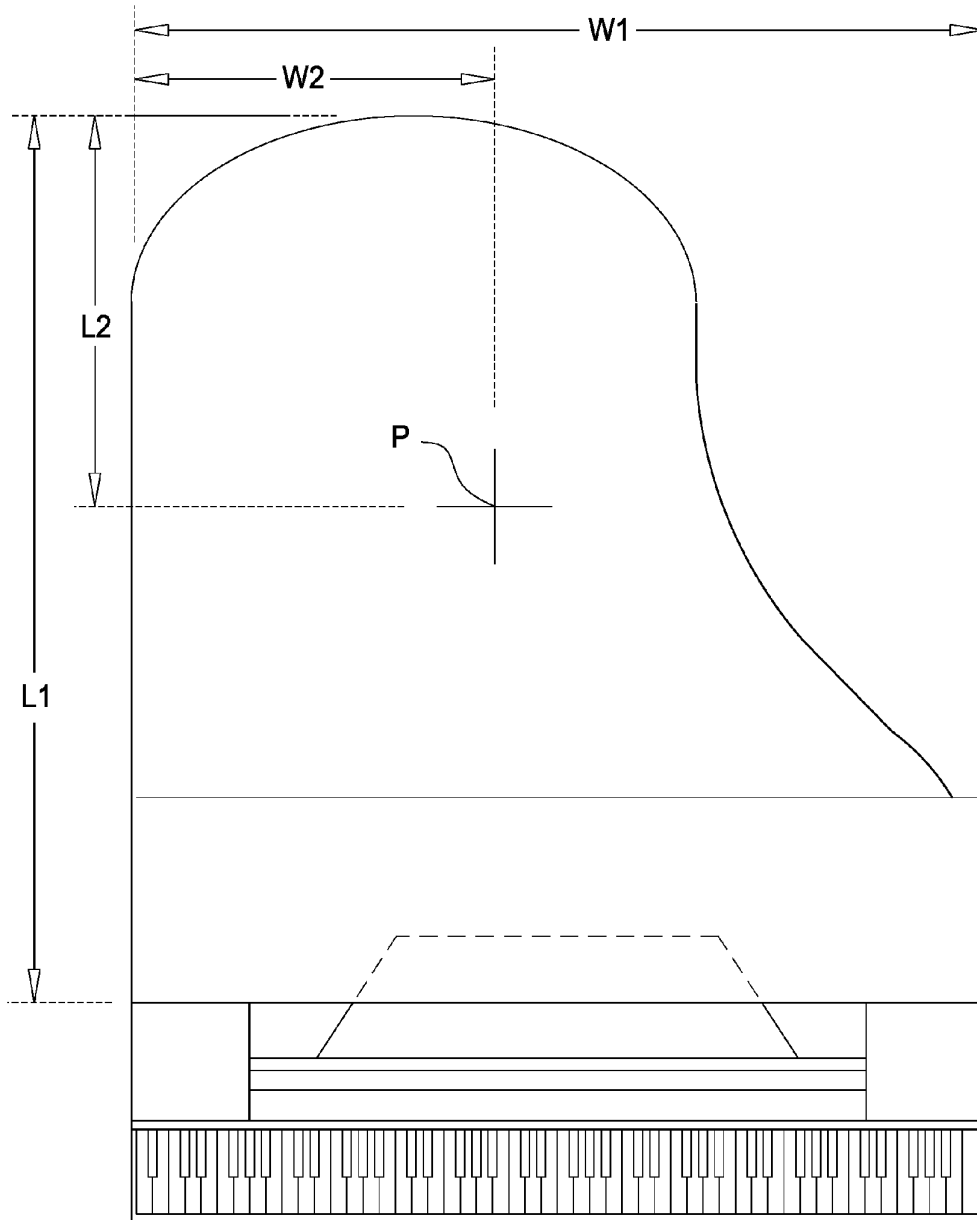


FIG.9

**SUPPORT FOR A PIANO LID**

## CROSS REFERENCE APPLICATIONS

This application claims the benefits of provisional application No. 61/021,263 filed Jan. 15, 2008 and is a continuation-in-part of international application PCT/US2009/030859 filed Jan. 13, 2009, each of which is hereby incorporated herein by reference for all purposes.

## FIELD OF INVENTION

The present invention relates to a mechanism and method for assisting users in lifting and supporting a piano lid. More specifically, it consists of a mechanism which uses at least one pneumatic cylinder to assist a user in opening and closing a piano lid.

## BACKGROUND

It is often necessary to open the lid of a piano and hold it open. Hinges and braces have been used to open a piano lid and support its weight for some time. Several difficulties exist in opening a piano lid, keeping it open, and eventually closing it. The piano lid is very heavy and can be difficult to raise. Once the lid is raised, it can be difficult to place the end of the brace into the receiving mechanism. Many braces can be easily knocked out of place, causing the lid to drop. When the heavy lid is closed, it can easily overcome the user's strength and fall too quickly, potentially injuring either the user or the piano. Additionally, traditional hinges and braces do not allow a user to bring a piano lid to rest anywhere between an open and closed position.

The foregoing example of the related art and limitations related therewith are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the drawings.

## SUMMARY

An aspect of the invention is to assist the user in opening a piano lid.

Another aspect of the invention is to damp the closing motion of a piano lid.

A further aspect of the invention is to stop a piano lid at any point between open and closed.

The following embodiments and aspects thereof are described and illustrated in conjunction with systems, tool and methods which are meant to be exemplary and illustrative, not limiting in scope. In various embodiments, one or more of the above described problems have been reduced or eliminated, while other embodiments are directed to other improvements.

One embodiment discloses a pneumatic cylinder attached to the frame of a piano. An arm is pivotally attached to the lid of the piano. The pneumatic cylinder and arm are connected. The disclosed embodiment has one arm and one pneumatic cylinder. More arms and cylinders are possible. The pneumatic cylinder and arm can be retrofit to a piano.

Another embodiment discloses an internal brace attached to the frame of the piano. An arm is removably attached to the lid of the piano. The brace has two pneumatic cylinders removably attached to it. The brace and cylinders are pivotally attached to the arm. More arms and cylinders are possible. The pneumatic cylinder and arm can be retrofit to a piano.

A further embodiment discloses two arms removably attached to the lid of a piano. Each arm is attached to a pneumatic cylinder. A guiding cup is removably attached to the frame of the piano below each arm and pneumatic cylinder. When the piano lid is closed, the base of the pneumatic cylinder engages the guiding cup. More arms and pneumatic cylinders are possible. Because the pneumatic cylinder is not attached to the piano frame, the piano lid can be completely removed without the use of tools.

Another embodiment discloses an arm removably attached to a housing. The housing is removably attached to a mounting bracket. The arm is attached to a pair of pneumatic cylinders. Guiding cups are mounted in the housing below each arm and pneumatic cylinder. When the piano lid is closed, the base of the pneumatic cylinder engages the guiding cup. The mounting bracket can be placed over the rear frame of the piano without any modification to the piano.

In addition to the exemplary aspects and embodiments described above, further aspects and embodiments will become apparent by reference to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side perspective view of an embodiment of a mechanism for supporting the weight of a piano lid.

FIG. 2 is a longitudinal sectional view of a second embodiment of a mechanism for supporting the weight of a piano lid.

FIG. 3 is a perspective view of the embodiment shown in FIG. 2.

FIG. 4 is a longitudinal sectional view of a third embodiment of a mechanism for supporting the weight of a piano lid.

FIG. 5 is a similar view of the embodiment shown in FIG. 4 with the lid partially open.

FIG. 6 is a similar view of the embodiment shown in FIG. 4 with the lid lifted more than 90° open and separated from the piano.

FIG. 7 is a longitudinal sectional view of a fourth embodiment of a mechanism for supporting the weight of a piano lid.

FIG. 8 is a perspective view of the embodiment shown in FIG. 7.

FIG. 9 is a top plan view of a grand piano.

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than limiting. Also, the terminology used herein is for the purpose of description and not of limitation.

## DETAILED DESCRIPTION

Referring first to FIG. 1 a piano 100 includes a lid support 1000 and has an arm 101 attached to the underside of the lid 102. The lid 102 is attached to the rear frame 104 of the piano 100 by hinge 114. The lid 102 is shown in the open position. Arm 101 is approximately 40 inches long, approximately 1 inch wide and approximately 1 inch high. Alternatively, arm 101 can end at point P, which represents the center of gravity of the lid 102. Extending arm 101 beyond point P reduces stress on hinge 114. In the depicted embodiment, arm 101 is 16 gauge mild steel. While 16 gauge mild steel is depicted, any material of similar strength and rigidity, including, but



not limited to metals, plastics and ceramics, could be used. Roller **116** rolls on the interior portion of a second end of arm **101**. In the depicted embodiment, roller **116** is approximately 15 mm in diameter and 20 mm in width and is nylon. While a nylon roller is depicted, a roller made of any material of similar strength and rigidity could be used. Roller **116** protrudes from the second end of arm **101** approximately 1-2 mm and contacts lid **102**. No special treatment of the underside of lid **102** is required. Arm **101** is substantially parallel to the underside of lid **102** when lid **102** is in a closed position. As lid **102** is rotated from a closed to an open position, the second end of arm **101** traverses the underside of piano lid **102** and the angle  $\alpha$  (depicted in FIG. 2) between the second end of arm **101** and piano lid **102** increases to a range of approximately 1-3 degrees.

A first end of arm **101** is attached at pivot point **115** to mounting bracket **112**. Mounting bracket **112** has a leg **113** that extends downward through a hole **110** in the sounding board **111**. In the depicted embodiment, mounting bracket **112** is 1"×1" angle, mild steel. While 1"×1" angle, mild steel is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used. Hole **110** has an approximate diameter of 2 inches. Mounting bracket **112** is attached to the upper interior portion **103** of rear frame **104**. The top of mounting bracket **112** is substantially coplanar with hinge **114**. The joint of hinge **114** is located on the opposing side of rear frame **104** from mounting bracket **112**.

An adjustable pivotal connector **105** is removably attached to arm **101** at a distance determined by the equation  $W=(X \cdot F)/L$ , where  $W$ =the weight to lift,  $X$ =the distance from the center of pivot point **119** to the center of pivot point **115**,  $L$ =the distance from roller **116** to pivot point **115** and  $F$ =the force needed in pneumatic cylinder **107** to lift the weight of lid **102**. Bolt **120** is slideable within slot **117** to adjust pivotal connector **105**. The piston arm **106** of a pneumatic cylinder **107** is removably attached to the adjustable pivotal connector **105** at pivot point **119**. The lower portion **108** of the pneumatic cylinder **107** is pivotally attached to the leg **113** of mounting bracket **112**. Leg **113** is connected to the lower interior portion **109** of the rear frame **104** of piano **100**. For the purposes of this application, the rear frame of piano **100** refers to the side on which the hinge for the piano lid is located.

Once lid support **1000** is installed, piano lid **102** can be opened and closed with ease. Additionally, piano lid **102** can now be stopped at any point between open and closed. A user can open, close or stop the lid with as little as one half Newton of force, the equivalent of the force exerted by a single finger. In the disclosed embodiment pneumatic cylinder **107** can be a range of sizes exerting between approximately 50 Newtons of force to approximately 1,300 Newtons of force. In the depicted embodiment, pneumatic cylinder **107** has an extended length of 7½ inches, a diameter of 1 inch, a ⅜ inch cylinder rod, a 2 inch stroke and exerts 1,000 Newtons of force. As shown in FIGS. 2 and 3, a second embodiment, lid support **2000**, a mechanism for supporting weight of piano lid is shown. Lid **202** is attached to the rear frame **204** of piano **100** by hinge **214**. For the purposes of this application, the rear frame of piano **100** refers to the side on which the hinge for the piano lid is located. Lid **202** is shown in the open position. An arm **201** rolls on the underside of the lid **202**. No special treatment of the underside of lid **202** is required. A first end of arm **201** is attached to the rear upper portion **212** of a bracket **213** at pivot point **215**. Bracket **213** is attached to the upper interior portion **203** of the rear frame **204** of piano **100** and the sounding board **211**. The top of bracket **213** is substantially coplanar with hinge **214**. The joint of the hinge **214**

is located on the opposing side of rear frame **204** from bracket **213**. In the depicted embodiment, bracket **213** is made from 1"×1" square tube, 16 gauge mild steel. While 1"×1" square tube, 16 gauge mild steel is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used.

Arm **201** is approximately 40 inches long, approximately 1 inch wide and approximately 1 inch high. Alternatively, arm **201** can end at the center of gravity of lid **202**. Extending arm **201** beyond the center of gravity of lid **202** reduces stress on hinge **214**. In the depicted embodiment, arm **201** is made from 16 gauge mild steel. While 16 gauge mild steel is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used. Roller **216** is attached to the interior portion of a second end of arm **201**. In the depicted embodiment, roller **216** is approximately 15 mm in diameter, 20 mm in width and is nylon. While a nylon roller is depicted, a roller made of any material of similar strength and rigidity could be used. Roller **216** protrudes from the second end of arm **201** approximately 1-2 mm and contacts lid **202**. Arm **201** is substantially parallel to the underside of lid **202** when lid **202** is in a closed position. As lid **202** is rotated from a closed to an open position, the angle represented by  $\alpha$  increases from approximately 0 degrees to approximately 1-3 degrees, the angle represented by  $\beta$  increases to approximately 132-150 degrees and the angle represented by  $\gamma$  increases to approximately 32-45 degrees.

Adjustable pivotal connector **205** is removably attached to opposing sides of the arm **201** at a distance determined by the equation  $W=(X \cdot F)/L$ , where  $W$ =the weight to lift,  $X$ =the distance from the center of pivot point **219** to the center of pivot point **215**,  $L$ =the distance from roller **216** to pivot point **215** and  $F$ =the force needed in pneumatic cylinders **207**, **207a** to lift the weight of lid **202**. Bolt **220** is slideable within slot **217** to adjust pivotal connector **205**. The piston arms **206** of pneumatic cylinders **207**, **207a** are removably attached to adjustable pivotal connector **205** at pivot point **219**. The lower portion **208** of pneumatic cylinders **207**, **207a** are removably attached to opposing sides of area A of the bracket **213** at pivot point **224**.

Optionally, a leg **223** can be attached to the lower portion of bracket **213** to provide structural support. Leg **223** extends through a hole **210** in the sounding board **211** and is removably attached to bracket **221** with nuts **222a**, **222b**. In the depicted embodiment, hole **210** has an approximate diameter of ½ inch. Bracket **221** is attached to the lower portion **209** of the rear frame **204** of piano **100** with bolt **224**.

Once lid support **2000** is installed, piano lid **202** can be opened and closed with ease. Additionally, piano lid **202** can now be stopped at any point between open and closed. A user can open, close or stop the lid with as little as one half Newton of force, the equivalent of the force exerted by a single finger.

In the disclosed embodiment pneumatic cylinder **207** can be a range of sizes exerting between approximately 50 Newtons of force to approximately 1,300 Newtons of force. In the depicted embodiment, pneumatic cylinder **207** has an extended length of 7½ inches, a diameter of 1 inch, a ⅜ inch cylinder rod, a 2 inch stroke and exerts 1,000 Newtons of force.

As shown in FIGS. 4, 5 and 6, a third embodiment, lid support **3000**, a mechanism for supporting the weight of piano lid **302**, has an arm **301** attached to the underside of the lid **302** of piano **100**. A first end **316** of arm **301** has a recessed opening **317**. Arm **301** is approximately 40 inches long, approximately 1 inch wide and approximately 1 inch high. Alternatively, arm **301** can end at the center of gravity of the

lid 302. In the depicted embodiment, arm 301 is 16 gauge mild steel. While 16 gauge mild steel is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used.

Adjustable pivotal connector 305 is removably attached to opposing sides of arm 301 at a distance determined by the equation  $W=(X \cdot F)/L$ , where  $W$ =the weight to lift,  $X$ =the distance from the center of pivot point 319 to the center of pin 315,  $L$ =the distance from the second end of arm 301 to pin 315 and  $F$ =the force needed in pneumatic cylinder 307 to lift the weight of lid 302. Bolt 320 is slideable within slot 317 to adjust pivotal connector 305.

The piston arm 306 of a pneumatic cylinder 307 is attached to adjustable pivotal connector 305 at pivot point 319. The upper portion 318 of a bracket 313 is attached to the upper portion of the rear frame 304 of piano 100. A guiding cup 321 is attached to area D of bracket 313. Area D is approximately one third of the distance total depth of bracket 313 from the frontal portion of bracket 313. Guiding cup 325 is conical in shape. The base E of guiding cup 325 is just large enough to accept the piston arm 322 of pneumatic cylinder 307. When lid 302 is closed, gravity will pull piston arm 322 into guiding cup 321. The conical shape of guiding cup 325 will cause the piston arm 322 of pneumatic cylinder 307 to rest in the base E of guiding cup 325.

In the depicted embodiment, bracket 313 is made from 1"x1" square tube, 16 gauge mild steel. While 1"x1" square tube, 16 gauge mild steel is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used. In the depicted embodiment, pneumatic cylinder 307 can be a range of sizes exerting between approximately 50 Newtons of force and approximately 1,300 Newtons of force. In the depicted embodiment, the cylinder has an extended length of 7½ inches, a diameter of 1 inch, a ⅜ inch cylinder rod, a 2 inch stroke and exerts 1,000 Newtons of force.

The interaction of the upper portion 318 of bracket 313 and recessed opening 317 of arm 301 acts as a hinge to attach lid 302 to the rear frame 304 of piano 100. A pin 315 is inserted in recessed opening 317 and acts as a joint for the created hinge. The interior portion 333 of pin 315 is missing a portion of its circumference. In the depicted embodiment, pin 315 is approximately 2½ long. The missing portion of the circumference of the interior portion 333 of pin 315 and the size of recessed opening 317 are proportionate. Recessed opening 317 of arm 301 extends greater than 180 degrees around the circumference of pin 315. Thus, lid 302 must be lifted beyond 90 degrees (see dotted line of 90 degrees marked "90°" in FIG. 6) in order to remove the lid 302 from piano 100. Once lid 302 is lifted beyond approximately 90 degrees, the missing portion of the circumference of the interior portion 333 of pin 315 allows lid 302 to be completely removed from piano 100. Extending arm 301 beyond the center of gravity of lid 302 reduces stress on the upper portion 318 of bracket 313 and recessed opening 317 of arm 301, which act as the hinge to attach lid 302 to piano 100.

Optionally, a leg 323 can be attached to the lower portion of bracket 313 to provide structural support. Leg 323 extends through a hole 310 in the sounding board 311 and is removably attached to bracket 321 with nuts 322a, 322b. Hole 310 has an approximate diameter of ½ inch. Bracket 321 is attached to the lower portion 309 of the rear frame 304 of the piano 100 with bolt 324. For the purposes of this application, the rear frame of piano 100 refers to the side on which the hinge for the piano lid is located.

The disclosed third embodiment 3000 has an arm assembly on the opposite side of the piano that is a mirror image of that disclosed in FIGS. 4, 5 and 6.

Once lid support 3000 is installed, piano lid 302 can be opened and closed with ease. Additionally, piano lid 302 can now be stopped at any point between open and closed. A user can open, close or stop the lid with as little as one half Newton of force, the equivalent of the force exerted by a single finger.

FIG. 4 shows the lid 302 in the closed position.

FIG. 5 shows the lid 302 raised from the closed position. FIG. 6 shows the lid 302 completely removed from the piano.

As shown in FIGS. 7 and 8, a fourth embodiment, lid support 4000, a mechanism for supporting the weight of piano lid 402, has a mounting bracket 413 placed over the rear frame 404 of the piano 100. For the purposes of this application, the rear frame of piano 100 refers to the side on which the hinge for the piano lid is located. In the depicted embodiment, bracket 413 is 16 gauge mild steel sheet metal. While 16 gauge mild steel sheet metal is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used. The internal surface of mounting bracket 413 is coated with felt so as not to scratch the surface of the piano. While felt is the preferred material, any material that would prevent scratching could be used. Mounting bracket 413 has a recessed portion 414 in the approximate center of its front face 415. Mounting bracket 413 has holes (not shown) on either side of recessed portion 414. Connector 428a extends generally perpendicular to front face 415 of mounting bracket 413. Connector 428a includes slots 429a. A mirror image connector extends from the other side of mounting bracket 413 and is not shown. The top of mounting bracket 413 is substantially coplanar with the hinge connecting lid 402 to the rear frame 404 of piano 100. The joint of the hinge connecting lid 402 to the rear frame 404 of piano 100 is located on the opposing side of rear frame 1404 from front face 415 of mounting bracket 413. In the disclosed embodiment, mounting bracket 413 is approximately 10 inches long, approximately 1.25 inches high and approximately 1.5-2 inches wide. In the disclosed embodiment, recessed portion 414 of mounting bracket 413 is approximately 2.5 inches long.

A housing 417 is attached to mounting bracket 413. In the depicted embodiment, housing 417 is 16 gauge mild steel sheet metal. While 16 gauge mild steel sheet metal is depicted, any material of similar strength and rigidity, including, but not limited to metals, plastics and ceramics, could be used. Housing 417 has a width approximately equal to that of the recessed portion of mounting bracket 413. In the disclosed embodiment, housing 417 has a length of approximately 4 inches, a height of approximately 5.5 inches, and a width of approximately 2.5 inches. Housing 417 has extension 418a. In the disclosed embodiment, extension 418a has a width of 0.75 inches. Extension 418a extends behind front face 415 of mounting bracket 413 and is attached thereto via screw 419a. In the disclosed embodiment screw 419a is a socket head bolt ⅝"-18x¾". The rear face of extension 418a is coated with felt. While felt is the preferred material, any material that would prevent scratching could be used. Housing 417 has a mirror image extension on its other side, which is not shown. Screw 430a further attaches housing 417 to mounting bracket 413. Screw 430a is slideable within slot 429a. In use, the interaction of screw 430a and slot 429a functions to prevent connector 428a and housing 417 from moving when bolt 419a is tightened. Bracket 406a also functions to prevent connector 428a and housing 417 from moving when bolt 419a is tightened. Screw 430a, slot 429a and bracket 406a can all be used together. Alternatively, a user may choose to

use either screw **430a** and slot **429a** or bracket **406a**. It should be understood that any method that can prevent connector **428a** and housing **417** from moving when bolt **419a** is tightened may also be used. The base **419** of housing **417** has guiding cups **421a**, **421b** in area D. Area D is approximately one third of the distance from the frontal portion of housing **417**. Guiding cups **421a**, **421b** are conical in shape.

An arm **401** is attached to housing **417** via a pin **420**. Pin **420** transverses a first end of arm **401** and mounts in housing **417**. In the disclosed embodiment pin **420** has a diameter of approximately  $\frac{3}{8}$ ". A second end of arm **401** rolls on the underside of lid **402** via roller **416**. No special treatment of the underside of lid **402** is required. Roller **416** is attached to the interior portion of the second end of arm **402**. Arm **401** is substantially parallel to the underside of lid **402** when lid **402** is in a closed position. As lid **402** is rotated from a closed to an open position, the second end of arm **401** traverses the underside of piano lid **402** and the angle represented by  $\alpha$  increases from approximately 0 degrees to approximately 1-3 degrees, the angle represented by  $\beta$  increases to approximately 132-150 degrees and the angle represented by  $\gamma$  increases to approximately 32-45 degrees.

Arm **401** is approximately 40 inches long, approximately 1 inch wide and approximately 1 inch high. In the depicted embodiment, arm **401** is 16 gauge mild steel. Alternatively, arm **401** can end at the center of gravity of the lid **402**. Extending arm **401** beyond the center of gravity of lid **402** reduces stress on the existing hinges. In the depicted embodiment, roller **416** is approximately 15 mm in diameter, 20 mm in width and is nylon. While a nylon roller is depicted, a roller made of any material of similar strength and rigidity could be used. Roller **416** protrudes from the second end of arm **401** approximately 1-2 mm and contacts lid **402**.

Bracket **423** is removably attached to the underside of arm **401**. A pin **424** is attached to bracket **423**. Pneumatic cylinders **407a**, **407b** are attached via eyelets **425a**, **425b** to either side of pin **424**. In the disclosed embodiment pin **424** and eyelets **425a**, **425b** each have a diameter of approximately  $\frac{3}{8}$ ". The location of bracket **423** on arm **401** is determined by the equation  $W=(X \cdot F)/L$ , where  $W$ =the weight to lift,  $X$ =the distance from the center of pin **424** to the center of pin **420**,  $L$ =the distance from roller **416** to pin **420** and  $F$ =the force needed in pneumatic cylinder **407a**, **407b** to lift the weight of lid **402**.

The base E of guiding cups **421a**, **421b** is just large enough to accept the piston arms **422a**, **422b** of pneumatic cylinders **407a**, **407b**. When lid **402** is closed, gravity will pull piston arms **422a**, **422b** into guiding cups **421a**, **421b**. The conical shape of guiding cups **421a**, **421b** will cause the piston arms **422a**, **422b** of pneumatic cylinder **407a**, **407b** to rest in the base E of guiding cups **421a**, **421b**.

Pneumatic cylinder **407** can be a range of sizes exerting between approximately 50 Newtons of force and approximately 1,300 Newtons of force. In a preferred embodiment, the cylinder has an extended length of  $7\frac{1}{2}$  inches, a diameter of 1 inch, a  $\frac{3}{8}$  inch cylinder rod, a 2 inch stroke and exerts 1,000 Newtons of force.

In use, mounting bracket **413** is placed over the rear frame **404** of a piano **100** at a chosen point between the existing hinges. Screws **419a**, **419b** are used to tighten lid support **4000** onto the piano **100**. Piano lid **402** can now be opened and closed with ease. Additionally, piano lid **402** can now be stopped at any point between open and closed. A user can open, close or stop the lid with as little as one half Newton of force, the equivalent of the force exerted by a single finger.

FIG. 9 shows a top plan view of a grand piano. Grand piano lid **502** has a width, measured between  $W1$  and  $W2$ , of

approximately 150 cm. Grand piano lid **502** has a length, measured between  $L1$  and  $L2$ , of between approximately 140 cm and 275 cm, depending on the type of grand piano. Grand piano lid **502** weighs between 21 and 65 pounds, depending on the type of grand piano. The center of gravity P for grand piano lid **502** is located between 55 and 60% of the total length of piano lid **502** when measured from  $L2$  and between 40 and 45% of the total width of piano lid **502** when measured from  $W1$ . Variation in the center of gravity is caused by variations in the size and shape of piano lid **502**. The lid support of the present invention can be adjusted along the length of the piano **100** during installation to locate the exact center of gravity. The disclosed embodiments of the present invention can be used with a grand piano as disclosed in FIG. 9. A single lid support of the present invention can support a lid of up to approximately 45 pounds having a length of up to approximately 214 cm. Two lid supports of the present invention are utilized to support a lid of greater than approximately 45 pounds having a length of greater than 214 cm.

While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain modifications, permutations, additions and sub-combinations therefore. It is therefore intended that the following appended claims hereinafter introduced are interpreted to include all such modifications, permutations, additions and sub-combinations are within their true spirit and scope. Each apparatus embodiment described herein has numerous equivalents.

I claim:

1. A support for a piano lid comprising:
  - an arm having a first end and a second end;
  - said second end in contact with an underside of a piano lid;
  - said first end pivotally attached to a mounting bracket;
  - said arm substantially parallel to said underside of a piano lid when said lid is in a closed position;
  - as said lid is rotated from a closed to an open position the second end of said arm traverses the underside of the piano lid and the angle between said second end of said arm and said lid increases to about 2 degrees;
  - said mounting bracket attached to the rear frame of a piano; and
  - a pneumatic cylinder pivotally attached to said arm;
  - wherein said arm will fully support said piano lid at any chosen open position.
2. The apparatus of claim 1, wherein said mounting bracket further comprises a leg extending below the bracket, said bracket attached to said rear frame below the sounding board.
3. The apparatus as claimed in claim 1 having multiple pneumatic cylinders.
4. The apparatus as claimed in claim 1 wherein the top of the mounting bracket is substantially coplanar with a hinge connecting the piano lid to the rear frame.
5. The apparatus as claimed in claim 1 wherein the joint of a hinge connecting the piano lid to the rear frame is located on the opposing side of the rear frame from the mounting bracket.
6. The apparatus as claimed in claim 1 wherein the angle between the second end of the arm and the lid increases to about 3 degrees as said lid is rotated from a closed to an open position.
7. The apparatus as claimed in claim 1 wherein the angle between the second end of the arm and the lid increases to about 2 degrees as said lid is rotated from a closed to an open position.
8. A support for a piano lid comprising:
  - arm means for supporting a piano lid;
  - said arm means having a first end and a second end;

9

said arm means substantially parallel to said piano lid when said lid is in a closed position;

as said lid is rotated from a closed to an open position the second end of said arm means traverses the underside of the piano lid and the angle between said second end of said arm means and said lid increases to about 2 degrees; means for connecting said first end of said arm means to said piano;

a portion of said means for connecting substantially coplanar with a hinge connecting said piano lid to a rear frame of a piano;

the joint of said hinge located on the opposing side of said rear frame from said means for connecting;

means for assisting a user in opening a piano lid and dampening the closing motion of said piano lid;

said means for assisting a user in opening a piano lid and dampening the closing motion of said piano lid comprising a pneumatic cylinder; and

means for connecting said arm to said means for assisting a user in opening a piano lid and dampening the closing motion of said piano lid.

9. The apparatus of claim 6, wherein said means for connecting comprises a mounting bracket.

10. The apparatus as claimed in claim 8, wherein said means for assisting a user in opening a piano lid and dampening the closing motion of said piano lid comprises multiple pneumatic cylinders.

11. The apparatus as claimed in claim 8 wherein the angle between the second end of the arm and the lid increases to about 2 degrees as said lid is rotated from a closed to an open position.

12. The apparatus as claimed in one of claim 8 wherein the angle between the second end of the arm and the lid increases to about 2 degrees as said lid is rotated from a closed to an open position.

13. A support for a piano lid comprising:

an arm attached to the underside of a piano lid;

said arm having a first end and a second end;

said first end having a recessed opening;

a pneumatic cylinder pivotally attached to said arm;

a mounting bracket attached to the rear frame of a piano;

the interaction of said recessed opening and the upper portion of said mounting bracket creating a hinge;

a pin sized to fit into said recessed opening of said arm;

said pin having a portion of the circumference of its interior surface removed;

said pin forming the joint of said hinge;

said recessed opening extending more than 180 degrees around said pin;

wherein rotating said piano lid greater than approximately

90 degrees will allow removal of said lid from said piano.

14. The apparatus of claim 13, wherein said mounting bracket includes a guiding cup.

15. The apparatus as claimed in claim 13, wherein said mounting bracket further comprises a leg extending below the bracket, said bracket attached to said rear frame below a sounding board of said piano.

10

16. An apparatus for use with a piano, the piano having an upper interior portion of a frame of the piano, the apparatus comprising:

a mounting bracket;

said mounting bracket having a first portion extending parallel to the upper interior portion of a piano frame;

said mounting bracket having a second portion extending downward from said parallel portion on the outside of the piano frame;

said mounting bracket having a third portion extending downward from said parallel portion on the inside of the piano frame;

wherein said mounting bracket fits over said upper interior portion of the piano frame;

an arm having a first end and a second end;

said second end in contact with an underside of the lid of said piano;

said first end pivotally attached to said mounting bracket;

said arm substantially parallel to said underside of a piano lid when said lid is in a closed position;

as said lid is rotated from a closed to an open position the second end of said arm traverses the underside of the piano lid; and

a pneumatic cylinder pivotally attached to said arm.

17. A method for supporting a piano lid comprising the steps of:

lowering a mounting bracket over the upper interior portion of a piano frame;

said mounting bracket having a first portion extending parallel to the upper interior portion of a piano frame;

said mounting bracket having a second portion extending downward from said parallel portion;

said mounting bracket having a third portion extending downward from said parallel portion;

whereby said first portion is on top of the upper interior portion of the piano frame;

whereby the second portion is on the outside of the upper interior portion of the piano frame;

the method further comprising pivotally attaching a first end of an arm to the first portion of said mounting bracket;

the method further comprising pivotally attaching a pneumatic cylinder to said arm; and

the method further comprising placing the second end of said arm in contact with the piano lid.

18. The method of claim 17 further comprising opening the lid to at least 30 degrees.

19. The method of claim 18 wherein the lid stays open to at least 30 degrees when a user removes his or her hand.

20. The method of claim 17 wherein a user exerts as little as one half Newton of force to open the lid.

21. The apparatus of claim 1, wherein said arm extends to at least the approximate center of gravity of said piano lid.

\* \* \* \* \*